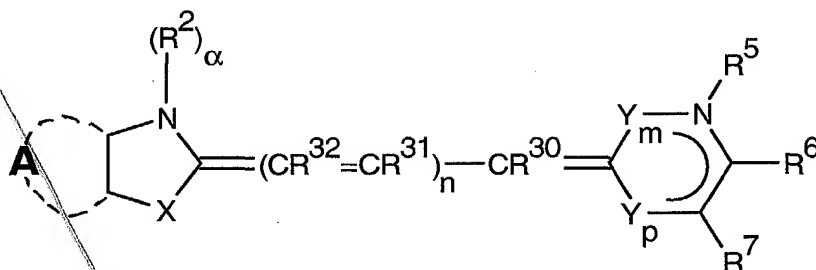


What is claimed is:

1. A compound of the formula



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

X is O, S, Se, NR<sup>15</sup>, or CR<sup>16</sup>R<sup>17</sup>, where R<sup>15</sup> is H or an alkyl group having 1-6 carbons; and R<sup>16</sup> and R<sup>17</sup>, which may be the same or different, are independently alkyl groups having 1-6 carbons, or R<sup>16</sup> and R<sup>17</sup> taken in combination complete a five or six membered saturated ring;

$\alpha$  is 0 or 1;

R<sup>2</sup> is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or R<sup>2</sup> is -L-R<sub>x</sub> or -L-S<sub>c</sub>; or TAIL; or BRIDGE-DYE;

n = 0, 1 or 2;

Y is -CR<sup>3</sup>=CR<sup>4</sup>-;

p and m = 0 or 1, such that p + m = 1;

R<sup>3</sup>, R<sup>4</sup>, R<sup>6</sup>, and R<sup>7</sup> are independently H; an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or -OR<sup>8</sup>, -SR<sup>8</sup>, -  
(NR<sup>8</sup>R<sup>9</sup>); or TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; where R<sup>8</sup> and R<sup>9</sup>, which can be the  
5 same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or  
aromatic rings; or R<sup>8</sup> and R<sup>9</sup> taken in combination are -(CH<sub>2</sub>)<sub>2</sub>-V-(CH<sub>2</sub>)<sub>2</sub>- where V is a single  
bond, -O-, -CH<sub>2</sub>-, or -NR<sup>10</sup>-, where R<sup>10</sup> is H or an alkyl having 1-6 carbons;

or R<sup>6</sup> and R<sup>7</sup> form a fused aromatic ring -R<sup>11</sup>=R<sup>12</sup>-R<sup>13</sup>=R<sup>14</sup>- wherein R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, and R<sup>14</sup>  
are optionally and independently alkyl that are saturated or unsaturated, linear or  
10 branched, having 1-6 carbons; or -OR<sup>8</sup>, -SR<sup>8</sup>, or -(NR<sup>8</sup>R<sup>9</sup>); or a CYCLIC SUBSTITUENT; or  
a TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

R<sup>5</sup> is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or  
R<sup>5</sup> is a CYCLIC SUBSTITUENT; or R<sup>5</sup> is TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; or R<sup>5</sup> is  
15 a pair of electrons;

R<sup>30</sup>, R<sup>31</sup>, and R<sup>32</sup> are independently H, C<sub>1</sub>-C<sub>6</sub> alkyl having 1-6 carbons, cycloalkyl having 3-  
10 carbons, aryl, or heteroaryl;

20 wherein

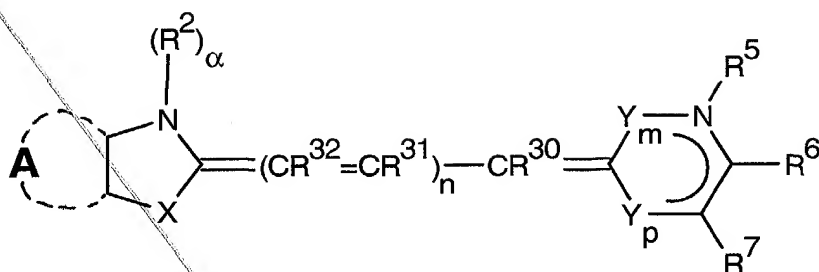
L and BRIDGE are independently a single covalent bond, or a covalent linkage that is  
linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16  
nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the  
25 linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single,  
double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur  
bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

R<sub>x</sub> is a reactive group;

S<sub>c</sub> is a conjugated substance;

TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



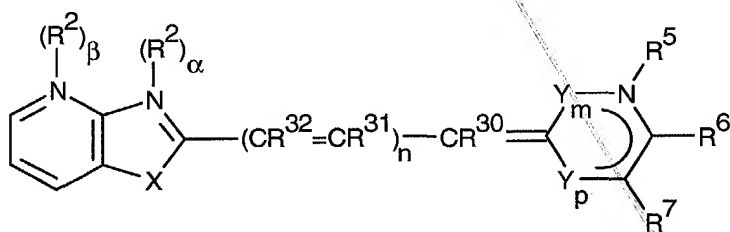
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wherein A, X, R<sup>2</sup>,  $\alpha$ , n, Y<sub>m</sub>, Y<sub>p</sub>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, R<sup>17</sup>, R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, R<sup>23</sup>, R<sup>24</sup>, R<sup>30</sup>, R<sup>31</sup>, R<sup>32</sup>, TAIL, CYCLIC SUBSTITUENT are as defined above;

10

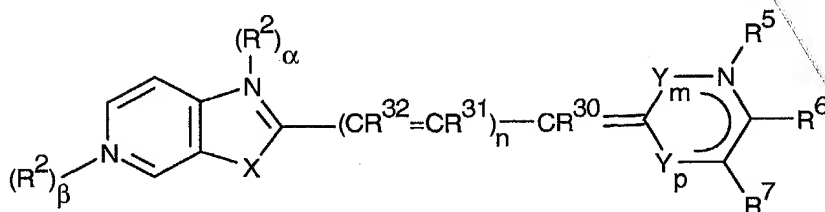
that is bound to BRIDGE at one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, or R<sup>7</sup>.

2. A compound, as claimed in Claim 1, having the formula

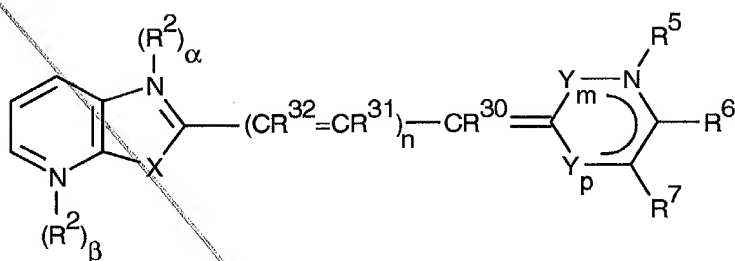


15

the formula

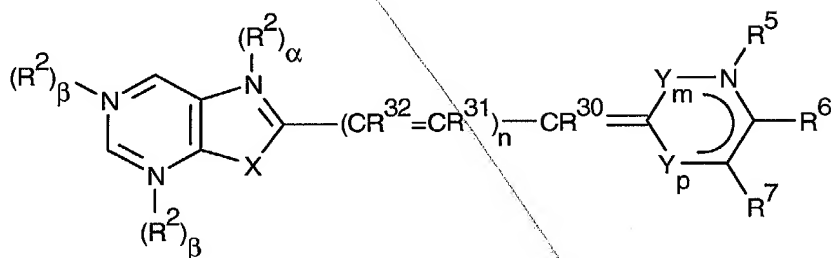


the formula



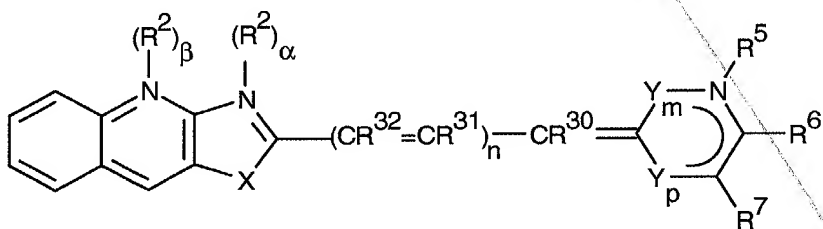
5

the formula



10

or the formula



15

wherein either  $\alpha$  or  $\beta$  is 1.

3. A compound, as claimed in Claim 1, wherein TAIL is a heteroatom-containing moiety having the formula LINK-SPACER-CAP;

wherein

LINK is a single covalent bond, -O-, -S-, or -NR<sup>20</sup>-; where R<sup>20</sup> is H, a linear or branched alkyl having 1-8 carbons, or R<sup>20</sup> is -SPACER'-CAP';

5

SPACER and SPACER', which may be the same or different, are covalent linkages, linear or branched, cyclic or heterocyclic, saturated or unsaturated, each having 1-16 nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single, double, 10 triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

CAP and CAP', which may be the same or different, are -O-R<sup>21</sup>, -S-R<sup>21</sup>, -NR<sup>21</sup>R<sup>22</sup>, or -N<sup>+</sup>R<sup>21</sup>R<sup>22</sup>R<sup>23</sup>Ψ<sup>-</sup>;

15

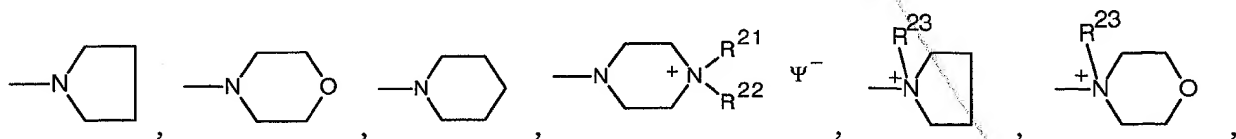
wherein

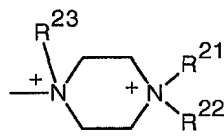
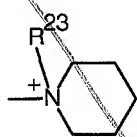
R<sup>21</sup>, R<sup>22</sup>, and R<sup>23</sup> are independently H, or a linear or branched alkyl or cycloalkyl having 1-8 carbons, optionally further substituted by hydroxy, alkoxy having 1-8 carbons, carboxyalkyl 20 having 1-8 carbons, or phenyl, where phenyl is optionally further substituted by halogen, hydroxy, alkoxy having 1-8 carbons, aminoalkyl having 1-8 carbons, or carboxyalkyl having 1-8 carbons; or, one or more of R<sup>21</sup>, R<sup>22</sup> and R<sup>23</sup>, taken in combination with SPACER or SPACER' or R<sup>20</sup> forms a 5- or 6-membered aromatic, heteroaromatic, alicyclic or heteroalicyclic ring, the heteroatoms selected from O, N or S; where Ψ<sup>-</sup> is a compatible 25 counterion;

or

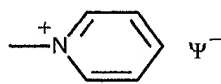
CAP and CAP' are independently

30

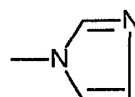




$\Psi^-$



$\Psi^-$



; where  $R^{21}$ ,  $R^{22}$ ,

$R^{23}$ , and  $\Psi^-$  are as defined previously.

4. A compound, as claimed in Claim 1, wherein each  $R^2$  is independently ethyl or methyl,  
 5 each X is independently O or S, each n is independently 0 or 1, and  $R^{30}$ ,  $R^{31}$ , and  $R^{32}$  are  
 each H.

5. A compound, as claimed in Claim 1, wherein at least one  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ ,  $R^7$ ,  $R^{11}$ ,  $R^{12}$ ,  $R^{13}$ ,  
 10 and  $R^{14}$  is a CYCLIC SUBSTITUENT that is a substituted or unsubstituted naphthyl,  
 phenyl, thienyl, or cycloalkyl having 3-8 carbons.

6. A compound, as claimed in Claim 1, wherein CAP and CAP', which may be the same or  
 different, are  $-NR^{21}R^{22}$ , or  $-N^+R^{21}R^{22}R^{23} \Psi^-$ , wherein  $R^{21}$ ,  $R^{22}$ , and  $R^{23}$  are independently H, or  
 a linear or branched alkyl or cycloalkyl having 1-8 carbons;  $R^{20}$  is H or a linear or branched  
 15 alkyl having 1-8 carbons; and SPACER and SPACER' are independently linear alkylenes  
 having 1-8 carbons; or incorporate a phenylene ring.

7. A compound, as claimed in Claim 1, wherein  $R^4$  is a TAIL or BRIDGE-DYE.

8. A compound, as claimed in Claim 1, wherein  $R^5$  is a TAIL; or a CYCLIC  
 20 SUBSTITUENT; or BRIDGE-DYE.

9. A compound, as claimed in Claim 8, wherein  $R^5$  is a TAIL or a BRIDGE-DYE, and TAIL  
 and BRIDGE incorporate at least one quaternary nitrogen atom.

10. A compound, as claimed in Claim 1, wherein each  $R^3$ ,  $R^{11}$ ,  $R^{12}$ ,  $R^{13}$  and  $R^{14}$  is hydrogen.

11. A compound, as claimed in Claim 1, wherein

30  $R^5$  is a linear or branched alkyl having 1-6 carbons; and

R<sup>4</sup> is halogen, a CYCLIC SUBSTITUENT, -OR<sup>8</sup>, -SR<sup>8</sup>, -(NR<sup>8</sup>R<sup>9</sup>), TAIL, BRIDGE-DYE, -L-R<sub>x</sub>, or -L-S<sub>c</sub>.

5 12. A compound, as claimed in Claim 1, wherein S<sub>c</sub> is an amino acid, a peptide, a protein, a polysaccharide, a nucleotide, an oligonucleotide, a nucleic acid, a lipid, a polymeric microparticle, a biological cell, or a virus.

10 13. A compound, as claimed in Claim 1, wherein S<sub>c</sub> is an oligonucleotide, a nucleic acid, or a DNA-binding protein.

14. A compound, as claimed in Claim 2, wherein

each X is O;

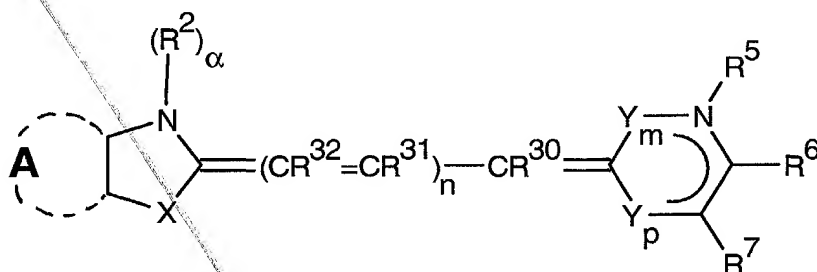
each n is independently = 0, 1, or 2;

each m = 1;

each R<sup>30</sup>, R<sup>31</sup>, and R<sup>32</sup> are H; and

R<sup>5</sup> is a linear or branched alkyl having 1-6 carbons, a TAIL, a CYCLIC SUBSTITUENT, or BRIDGE-DYE.

15. A fluorescent complex comprising a nucleic acid polymer non-covalently associated with one or more dye molecules, which may be the same or different, having the formula



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

X is O, S, Se, NR<sup>15</sup>, or CR<sup>16</sup>R<sup>17</sup>, where R<sup>15</sup> is H or an alkyl group having 1-6 carbons; and R<sup>16</sup> and R<sup>17</sup>, which may be the same or different, are independently alkyl groups having 1-6 carbons, or R<sup>16</sup> and R<sup>17</sup> taken in combination complete a five or six membered saturated ring;

α is 0 or 1;

R<sup>2</sup> is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or R<sup>2</sup> is -L-R<sub>x</sub> or -L-S<sub>c</sub>; or TAIL; or BRIDGE-DYE;

n = 0, 1 or 2;

Y is -CR<sup>3</sup>=CR<sup>4</sup>;

p and m = 0 or 1, such that p + m = 1;

R<sup>3</sup>, R<sup>4</sup>, R<sup>6</sup>, and R<sup>7</sup> are independently H; an alkyl that is saturated or unsaturated, linear or



branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or -OR<sup>8</sup>, -SR<sup>8</sup>, -  
(NR<sup>8</sup>R<sup>9</sup>); or TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; where R<sup>8</sup> and R<sup>9</sup>, which can be the  
same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or  
aromatic rings; or R<sup>8</sup> and R<sup>9</sup> taken in combination are -(CH<sub>2</sub>)<sub>2</sub>-V-(CH<sub>2</sub>)<sub>2</sub>- where V is a single  
5 bond, -O-, -CH<sub>2</sub>-, or -NR<sup>10</sup>-, where R<sup>10</sup> is H or an alkyl having 1-6 carbons;

or R<sup>6</sup> and R<sup>7</sup> form a fused aromatic ring -R<sup>11</sup>=R<sup>12</sup>-R<sup>13</sup>=R<sup>14</sup>- wherein R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, and R<sup>14</sup>  
are optionally and independently alkyl that are saturated or unsaturated, linear or  
branched, having 1-6 carbons; or -OR<sup>8</sup>, -SR<sup>8</sup>, or -(NR<sup>8</sup>R<sup>9</sup>); or a CYCLIC SUBSTITUENT; or  
10 a TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

R<sup>5</sup> is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or  
R<sup>5</sup> is a CYCLIC SUBSTITUENT; or R<sup>5</sup> is TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; or R<sup>5</sup> is  
a pair of electrons;

R<sup>30</sup>, R<sup>31</sup>, and R<sup>32</sup> are independently H, C<sub>1</sub>-C<sub>6</sub> alkyl having 1-6 carbons, cycloalkyl having 3-  
10 carbons, aryl, or heteroaryl;

wherein

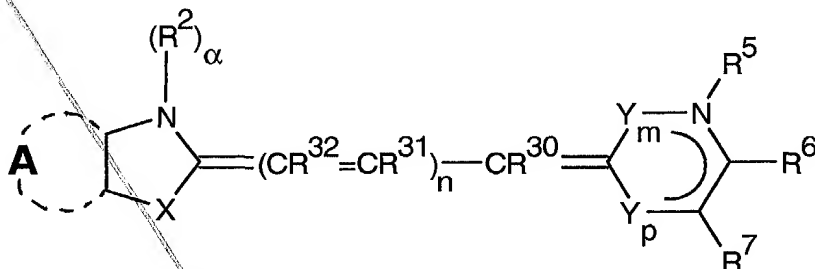
L and BRIDGE are independently a single covalent bond, or a covalent linkage that is  
linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16  
nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the  
linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single,  
25 double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur  
bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

R<sub>x</sub> is a reactive group;

30 S<sub>c</sub> is a conjugated substance;

TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



5 wherein A, X, R<sup>2</sup>, α, n, Y<sub>m</sub>, Y<sub>p</sub>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, R<sup>17</sup>, R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, R<sup>23</sup>, R<sup>24</sup>, R<sup>30</sup>, R<sup>31</sup>, R<sup>32</sup>, TAIL, CYCLIC SUBSTITUENT are as defined above;

that is bound to BRIDGE at one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, or R<sup>7</sup>.

10 16. A fluorescent complex, as claimed in Claim 15, wherein the nucleic acid polymer is a chromosome, or a natural or synthetic oligonucleotide.

15 17. A fluorescent complex, as claimed in Claim 15, wherein said complex is present in an electrophoretic matrix or in a flowing medium.

18. A fluorescent complex, as claimed in Claim 15, wherein said nucleic acid is obtained from a biological fluid.

20 19. A fluorescent complex, as claimed in Claim 15, wherein said complex is enclosed in a biological structure, or present in an aqueous or aqueous miscible solution.

20. A fluorescent complex, as claimed in Claim 19, wherein said complex is enclosed in a biological structure that is a cell.

25 21. A fluorescent complex, as claimed in Claim 20, wherein said cell is undergoing apoptosis, necrosis, or is in a cycle of growth or cell division.

22. A fluorescent complex, as claimed in Claim 15, wherein at least one dye molecule is substituted by -L-S<sub>C</sub>, where S<sub>C</sub> is a hapten, a nucleotide, an oligonucleotide, a nucleic acid polymer, a protein, or a polysaccharide.

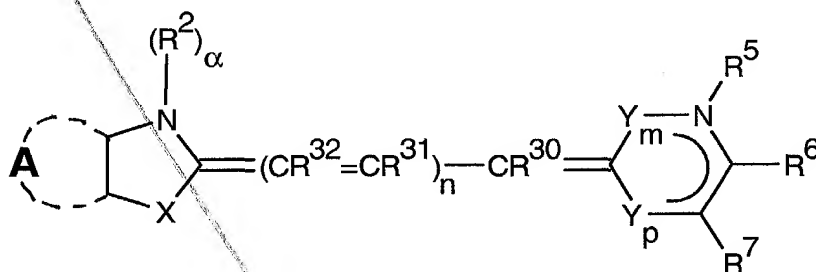
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23. A compound, as claimed in Claim 22, wherein S<sub>C</sub> is an oligonucleotide, a nucleic acid, or a DNA-binding protein.

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24. A composition comprising:

a) one or more cyanine dyes having the formula



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

X is O, S, Se, NR<sup>15</sup>, or CR<sup>16</sup>R<sup>17</sup>, where R<sup>15</sup> is H or an alkyl group having 1-6 carbons; and R<sup>16</sup> and R<sup>17</sup>, which may be the same or different, are independently alkyl groups having 1-6 carbons, or R<sup>16</sup> and R<sup>17</sup> taken in combination complete a five or six membered saturated ring;

α is 0 or 1;

R<sup>2</sup> is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or R<sup>2</sup> is -L-R<sub>x</sub> or -L-S<sub>c</sub>; or TAIL; or BRIDGE-DYE;

n = 0, 1 or 2;

Y is -CR<sup>3</sup>=CR<sup>4</sup>;

p and m = 0 or 1, such that p + m = 1;

5 R<sup>3</sup>, R<sup>4</sup>, R<sup>6</sup>, and R<sup>7</sup> are independently H; an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or -OR<sup>8</sup>, -SR<sup>8</sup>, -(NR<sup>8</sup>R<sup>9</sup>); or TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; where R<sup>8</sup> and R<sup>9</sup>, which can be the same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or aromatic rings; or R<sup>8</sup> and R<sup>9</sup> taken in combination are -(CH<sub>2</sub>)<sub>2</sub>-V-(CH<sub>2</sub>)<sub>2</sub>- where V is a single bond, -O-, -CH<sub>2</sub>-, or -NR<sup>10</sup>-, where R<sup>10</sup> is H or an alkyl having 1-6 carbons;

10 or R<sup>6</sup> and R<sup>7</sup> form a fused aromatic ring -R<sup>11</sup>=R<sup>12</sup>-R<sup>13</sup>=R<sup>14</sup>- wherein R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, and R<sup>14</sup> are optionally and independently alkyl that are saturated or unsaturated, linear or branched, having 1-6 carbons; or -OR<sup>8</sup>, -SR<sup>8</sup>, or -(NR<sup>8</sup>R<sup>9</sup>); or a CYCLIC SUBSTITUENT; or a TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

15 R<sup>5</sup> is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or R<sup>5</sup> is a CYCLIC SUBSTITUENT; or R<sup>5</sup> is TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; or R<sup>5</sup> is a pair of electrons;

20 R<sup>30</sup>, R<sup>31</sup>, and R<sup>32</sup> are independently H, C<sub>1</sub>-C<sub>6</sub> alkyl having 1-6 carbons, cycloalkyl having 3-10 carbons, aryl, or heteroaryl;

wherein

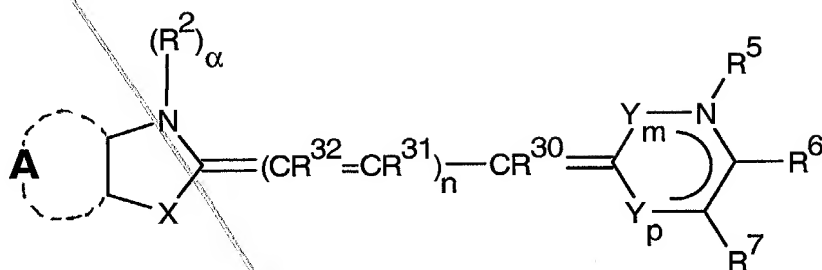
25 L and BRIDGE are independently a single covalent bond, or a covalent linkage that is linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16 nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single, double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

30 R<sub>x</sub> is a reactive group;

S<sub>c</sub> is a conjugated substance;

TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



wherein A, X, R<sup>2</sup>, α, n, Y<sub>m</sub>, Y<sub>p</sub>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, R<sup>17</sup>, R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, R<sup>23</sup>, R<sup>24</sup>, R<sup>30</sup>, R<sup>31</sup>, R<sup>32</sup>, TAIL, CYCLIC SUBSTITUENT are as defined above;

that is bound to BRIDGE at one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, or R<sup>7</sup>;

b) a detergent; and

c) a poly(amino acid),

in a cell-free aqueous solution where said detergent is present at a concentration less than the critical micelle concentration for that detergent.

25. A composition, as claimed in Claim 24, where said detergent is an alkyl sulfate or alkyl sulfonate salt.

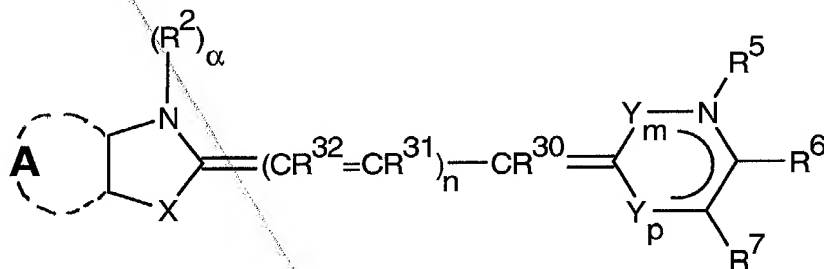
26. A composition, as claimed in Claim 24, wherein said poly(amino acids) are present on or in a solid or semi-solid matrix.

27. A composition, as claimed in Claim 26, wherein said matrix is a membrane or an electrophoretic gel.

28. A method of staining poly(amino acids), comprising the steps of:

a) combining a sample that contains or is thought to contain a poly(amino acid) with a staining mixture that contains one or more dyes having the formula

5



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

X is O, S, Se, NR<sup>15</sup>, or CR<sup>16</sup>R<sup>17</sup>, where R<sup>15</sup> is H or an alkyl group having 1-6 carbons; and R<sup>16</sup> and R<sup>17</sup>, which may be the same or different, are independently alkyl groups having 1-6 carbons, or R<sup>16</sup> and R<sup>17</sup> taken in combination complete a five or six membered saturated ring;

α is 0 or 1;

R<sup>2</sup> is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or R<sup>2</sup> is -L-R<sub>x</sub> or -L-S<sub>c</sub>; or TAIL; or BRIDGE-DYE;

n = 0, 1 or 2;

Y is -CR<sup>3</sup>=CR<sup>4</sup>-;

p and m = 0 or 1, such that p + m = 1;

R<sup>3</sup>, R<sup>4</sup>, R<sup>6</sup>, and R<sup>7</sup> are independently H; an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or -OR<sup>8</sup>, -SR<sup>8</sup>, -  
(NR<sup>8</sup>R<sup>9</sup>); or TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; where R<sup>8</sup> and R<sup>9</sup>, which can be the  
5 same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or aromatic rings; or R<sup>8</sup> and R<sup>9</sup> taken in combination are -(CH<sub>2</sub>)<sub>2</sub>-V-(CH<sub>2</sub>)<sub>2</sub>- where V is a single bond, -O-, -CH<sub>2</sub>-, or -NR<sup>10</sup>-, where R<sup>10</sup> is H or an alkyl having 1-6 carbons;

or R<sup>6</sup> and R<sup>7</sup> form a fused aromatic ring -R<sup>11</sup>=R<sup>12</sup>-R<sup>13</sup>=R<sup>14</sup>- wherein R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, and R<sup>14</sup>  
10 are optionally and independently alkyl that are saturated or unsaturated, linear or branched, having 1-6 carbons; or -OR<sup>8</sup>, -SR<sup>8</sup>, or -(NR<sup>8</sup>R<sup>9</sup>); or a CYCLIC SUBSTITUENT; or a TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>;

R<sup>5</sup> is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or  
15 R<sup>5</sup> is a CYCLIC SUBSTITUENT; or R<sup>5</sup> is TAIL; or BRIDGE-DYE; or -L-R<sub>x</sub>; or -L-S<sub>c</sub>; or R<sup>5</sup> is a pair of electrons;

R<sup>30</sup>, R<sup>31</sup>, and R<sup>32</sup> are independently H, C<sub>1</sub>-C<sub>6</sub> alkyl having 1-6 carbons, cycloalkyl having 3-  
20 10 carbons, aryl, or heteroaryl;

wherein

L and BRIDGE are independently a single covalent bond, or a covalent linkage that is  
linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16  
25 nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single, double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

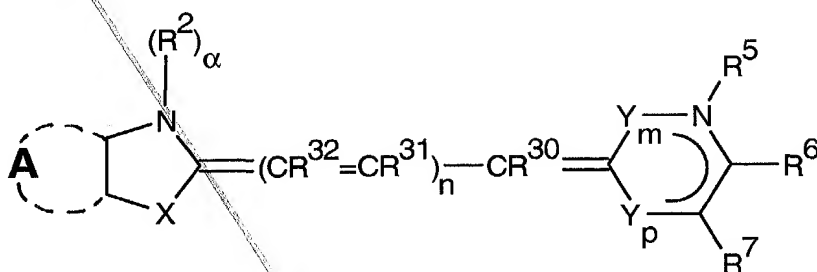
30 R<sub>x</sub> is a reactive group;

S<sub>c</sub> is a conjugated substance;



TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



wherein A, X, R<sup>2</sup>,  $\alpha$ , n, Y<sub>m</sub>, Y<sub>p</sub>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, R<sup>17</sup>, R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, R<sup>23</sup>, R<sup>24</sup>, R<sup>30</sup>, R<sup>31</sup>, R<sup>32</sup>, TAIL, CYCLIC SUBSTITUENT are as defined above;

that is bound to BRIDGE at one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, or R<sup>7</sup>;

b) incubating the combined mixture for a time sufficient for the dye in the staining mixture to associate with the poly(amino acid) in the sample mixture to form a dye-poly(amino acid) complex that gives a detectable optical response upon illumination;

d) illuminating said dye-poly(amino acid) complex; and

e) observing said detectable optical response.

29. A method, as claimed in Claim 28, further comprising heating the sample mixture prior to combining with the staining mixture, or heating the combined mixture.

30. A method, as claimed in Claim 28, further comprising removing, destroying, or dispersing below the critical micelle concentration any biological membranes that are present in the sample mixture.

31. A method, as claimed in Claim 28, further comprising adding an anionic detergent to the sample mixture, staining mixture or combined mixture.

32. A method, as claimed in Claim 31, wherein said detergent is an alkyl sulfate or alkyl sulfonate salt having 6-18 carbons; that is present in a concentration of less than 0.1% by weight.

33. A method, as claimed in Claim 28, wherein said detectable optical response is a colorimetric response.

34. A method, as claimed in Claim 28, wherein said detectable optical response is a fluorescence response.

35. A method, as claimed in Claim 28, further comprising quantitating said poly(amino acid) by measuring said detectable optical response and comparing said measurement with a standard.

36. A method, as claimed in Claim 28, further comprising electrophoretically separating the sample mixture before, after, or while it is combined with the staining mixture.

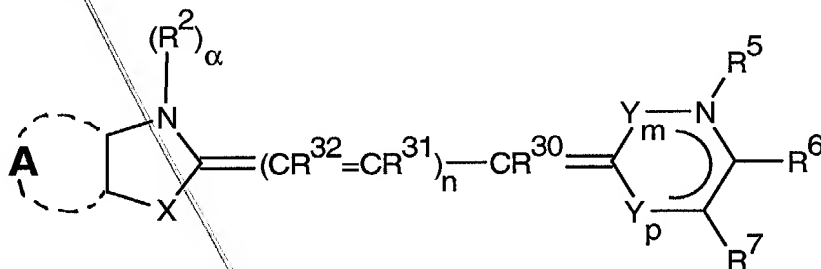
37. A method, as claimed in Claim 28, further comprising transferring the sample mixture to a solid or semi-solid matrix before or after combining with the staining mixture.

38. A method, as claimed in Claim 28, further comprising adding an additional reagent to the sample mixture, the staining mixture, or the combined mixture.

39. A method of staining nucleic acids, comprising

a) combining a sample that contains or is thought to contain a nucleic acid with a mixture containing a dye compound of the formula

5



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or  $-L-R_x$ ; or  $-L-S_c$ ;

X is O, S, Se,  $NR^{15}$ , or  $CR^{16}R^{17}$ , where  $R^{15}$  is H or an alkyl group having 1-6 carbons; and  $R^{16}$  and  $R^{17}$ , which may be the same or different, are independently alkyl groups having 1-6 carbons, or  $R^{16}$  and  $R^{17}$  taken in combination complete a five or six membered saturated ring;

$\alpha$  is 0 or 1;

$R^2$  is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or  $R^2$  is  $-L-R_x$  or  $-L-S_c$ ; or TAIL; or BRIDGE-DYE;

$n = 0, 1$  or  $2$ ;

Y is  $-CR^3=CR^4-$ ;

$p$  and  $m = 0$  or  $1$ , such that  $p + m = 1$ ;

5  $R^3, R^4, R^6$ , and  $R^7$  are independently H; an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or  $-OR^8$ ,  $-SR^8$ ,  $-(NR^8R^9)$ ; or TAIL; or BRIDGE-DYE; or  $-L-R_x$ ; or  $-L-S_c$ ; where  $R^8$  and  $R^9$ , which can be the same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or aromatic rings; or  $R^8$  and  $R^9$  taken in combination are  $-(CH_2)_2-V-(CH_2)_2-$  where V is a single bond,  $-O-$ ,  $-CH_2-$ , or  $-NR^{10}-$ , where  $R^{10}$  is H or an alkyl having 1-6 carbons;

10 or  $R^6$  and  $R^7$  form a fused aromatic ring  $-R^{11}=R^{12}-R^{13}=R^{14}-$  wherein  $R^{11}$ ,  $R^{12}$ ,  $R^{13}$ , and  $R^{14}$  are optionally and independently alkyl that are saturated or unsaturated, linear or branched, having 1-6 carbons; or  $-OR^8$ ,  $-SR^8$ , or  $-(NR^8R^9)$ ; or a CYCLIC SUBSTITUENT; or a TAIL; or BRIDGE-DYE; or  $-L-R_x$ ; or  $-L-S_c$ ;

15  $R^5$  is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or  $R^5$  is a CYCLIC SUBSTITUENT; or  $R^5$  is TAIL; or BRIDGE-DYE; or  $-L-R_x$ ; or  $-L-S_c$ ; or  $R^5$  is a pair of electrons;

20  $R^{30}$ ,  $R^{31}$ , and  $R^{32}$  are independently H,  $C_1-C_6$  alkyl having 1-6 carbons, cycloalkyl having 3-10 carbons, aryl, or heteroaryl;

wherein

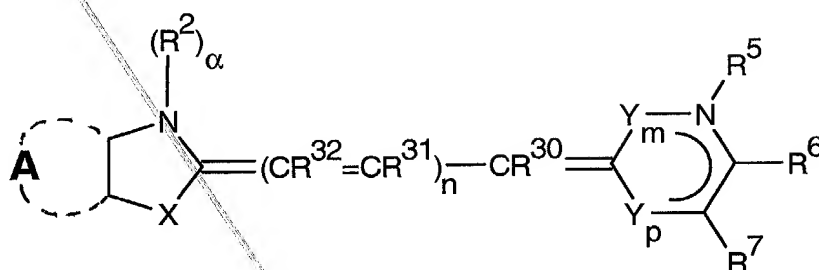
25 L and BRIDGE are independently a single covalent bond, or a covalent linkage that is linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16 nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single, double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

30  $R_x$  is a reactive group;

$S_c$  is a conjugated substance;

TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



wherein A, X,  $R^2$ ,  $\alpha$ , n,  $Y_m$ ,  $Y_p$ ,  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ ,  $R^7$ ,  $R^8$ ,  $R^9$ ,  $R^{10}$ ,  $R^{11}$ ,  $R^{12}$ ,  $R^{13}$ ,  $R^{14}$ ,  $R^{15}$ ,  $R^{16}$ ,  $R^{17}$ ,  $R^{18}$ ,  $R^{19}$ ,  $R^{20}$ ,  $R^{21}$ ,  $R^{22}$ ,  $R^{23}$ ,  $R^{24}$ ,  $R^{30}$ ,  $R^{31}$ ,  $R^{32}$ , TAIL, CYCLIC SUBSTITUENT are as defined above;

that is bound to BRIDGE at one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ , or  $R^7$ ;

b) incubating the sample and mixture for a time sufficient for the dye compound to combine with the nucleic acid in the sample to form one or more dye-nucleic acid complexes that give a detectable fluorescent signal.

40. A method of staining nucleic acids, as claimed in Claim 39, wherein said sample or said mixture comprises an electrophoretic gel.

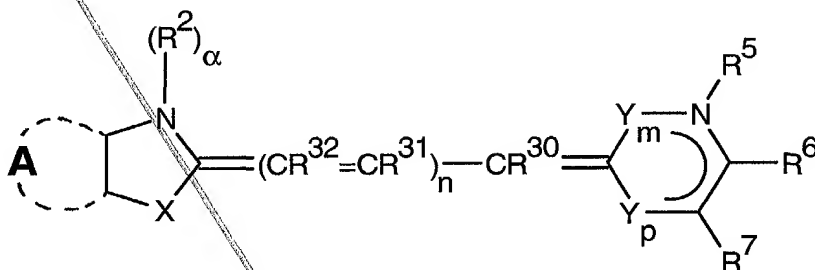
41. A method of staining nucleic acids, as claimed in Claim 39, wherein the sample comprises a biological fluid.

42. A method of staining nucleic acids, as claimed in Claim 39, wherein the sample comprises cells.

43. A method of staining nucleic acids, according to Claim 39, where the sample comprises cell-free nucleic acids.

44. A kit, comprising:

a) a compound of the formula



wherein A represents the atoms necessary to form one to two fused aromatic rings having 6 atoms in each ring, at least one of which is a nitrogen atom, said ring or rings being optionally further substituted one or more times by alkyl having from 1-6 carbons, alkoxy having from 1-6 carbons, trifluoromethyl, halogen, or  $-L-R_x$ ; or  $-L-S_c$ ;

X is O, S, Se,  $NR^{15}$ , or  $CR^{16}R^{17}$ , where  $R^{15}$  is H or an alkyl group having 1-6 carbons; and  $R^{16}$  and  $R^{17}$ , which may be the same or different, are independently alkyl groups having 1-6 carbons, or  $R^{16}$  and  $R^{17}$  taken in combination complete a five or six membered saturated ring;

$\alpha$  is 0 or 1;

$R^2$  is an alkyl group having 1-6 carbons that is optionally substituted by sulfonate, carboxy, or amino; or  $R^2$  is  $-L-R_x$  or  $-L-S_c$ ; or TAIL; or BRIDGE-DYE;

$n = 0, 1$  or  $2$ ;

Y is  $-CR^3=CR^4-$ ;

p and m = 0 or 1, such that  $p + m = 1$ ;

5  $R^3, R^4, R^6,$  and  $R^7$  are independently H; an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or a halogen; or a CYCLIC SUBSTITUENT; or  $-OR^8, -SR^8, -(NR^8R^9);$  or TAIL; or BRIDGE-DYE; or  $-L-R_x;$  or  $-L-S_c;$  where  $R^8$  and  $R^9,$  which can be the same or different, are independently alkyl groups having 1-6 carbons; or 1-2 alicyclic or aromatic rings; or  $R^8$  and  $R^9$  taken in combination are  $-(CH_2)_2-V-(CH_2)_2-$  where V is a single bond,  $-O-, -CH_2-,$  or  $-NR^{10}-,$  where  $R^{10}$  is H or an alkyl having 1-6 carbons;

10 or  $R^6$  and  $R^7$  form a fused aromatic ring  $-R^{11}=R^{12}-R^{13}=R^{14}-$  wherein  $R^{11}, R^{12}, R^{13},$  and  $R^{14}$  are optionally and independently alkyl that are saturated or unsaturated, linear or branched, having 1-6 carbons; or  $-OR^8, -SR^8,$  or  $-(NR^8R^9);$  or a CYCLIC SUBSTITUENT; or a TAIL; or BRIDGE-DYE; or  $-L-R_x;$  or  $-L-S_c;$

15  $R^5$  is an alkyl that is saturated or unsaturated, linear or branched, having 1-6 carbons; or  $R^5$  is a CYCLIC SUBSTITUENT; or  $R^5$  is TAIL; or BRIDGE-DYE; or  $-L-R_x;$  or  $-L-S_c;$  or  $R^5$  is a pair of electrons;

$R^{30}, R^{31},$  and  $R^{32}$  are independently H,  $C_1-C_6$  alkyl having 1-6 carbons, cycloalkyl having 3-10 carbons, aryl, or heteroaryl;

20 wherein

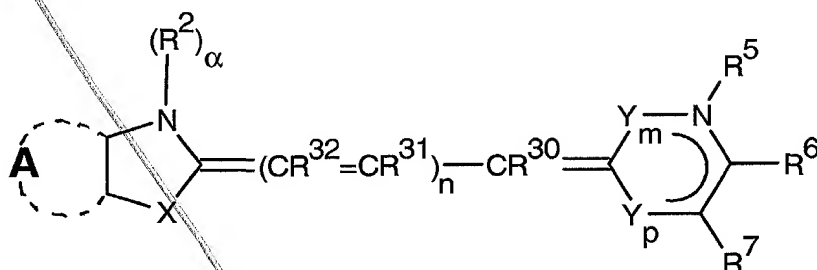
L and BRIDGE are independently a single covalent bond, or a covalent linkage that is linear or branched, cyclic or heterocyclic, saturated or unsaturated, having 1-16 nonhydrogen atoms selected from the group consisting of C, N, P, O and S, such that the linkage contains any combination of ether, thioether, amine, ester, amide bonds; or single, double, triple or aromatic carbon-carbon bonds; or phosphorus-oxygen, phosphorus-sulfur bonds, nitrogen-nitrogen or nitrogen-oxygen bonds; or aromatic or heteroaromatic bonds;

30  $R_x$  is a reactive group;

$S_c$  is a conjugated substance;

TAIL is a heteroatom-containing moiety;

DYE is a compound of the formula



wherein A, X, R<sup>2</sup>,  $\alpha$ , n, Y<sub>m</sub>, Y<sub>p</sub>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup>, R<sup>11</sup>, R<sup>12</sup>, R<sup>13</sup>, R<sup>14</sup>, R<sup>15</sup>, R<sup>16</sup>, R<sup>17</sup>, R<sup>18</sup>, R<sup>19</sup>, R<sup>20</sup>, R<sup>21</sup>, R<sup>22</sup>, R<sup>23</sup>, R<sup>24</sup>, R<sup>30</sup>, R<sup>31</sup>, R<sup>32</sup>, TAIL, CYCLIC SUBSTITUENT are as defined above;

that is bound to BRIDGE at one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, or R<sup>7</sup>;

wherein said compound is present as a stock solution.

45. A kit, as claimed in Claim 44, further comprising a buffer suitable for dilution of the stock solution.

46. A kit, as claimed in Claim 44, further comprising a fluorescence standard, a nucleic acid, a poly(amino acid), an additional detection reagent, a silicon chip, a glass slide, or any combination thereof.

47. A kit, as claimed in Claim 44, wherein the additional detection reagent is an organelle stain, an immunoreagent, a drug, an enzyme, or an enzyme substrate.